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ABSTRACT

Research and development (R&D) expenditures in 1984 are highlighted in this brief report. Areas considered include: (1) R&D and the gross national product (GNP); (2) R&D support; and (3) basic research, applied research, and development. Among the findings reported are those indicating: that in 1984, public and private sectors are expected to provide a combined total of $97 billion for R&D; that defense spending and economic conditions are major factors for this estimate of a significant increase in 1984 R&D support; and that indicators point to real growth of about 6 to 7 percent in R&D activities, with components of both basic and applied research estimated to grow at about similar rates. In addition, with respect to the ratio of R&D expenditures to GNP, the United States with a 2.7 percent average, draws closer to West Germany and continues ahead of other major industrialized western economies in R&D spending relative to total economic activities. Supporting data are provided in one table and four charts. (JN)

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SCIENCE RESOURCES STUDIES HIGHLIGHTS

NATIONAL SCIENCE FOUNDATION WASHINGTON, D.C. 20550 JULY 22, 1983 NSF 83-316

Defense and Economy Major Factors in 7% Real Growth in National R&D Expenditures in 1984

Highlights

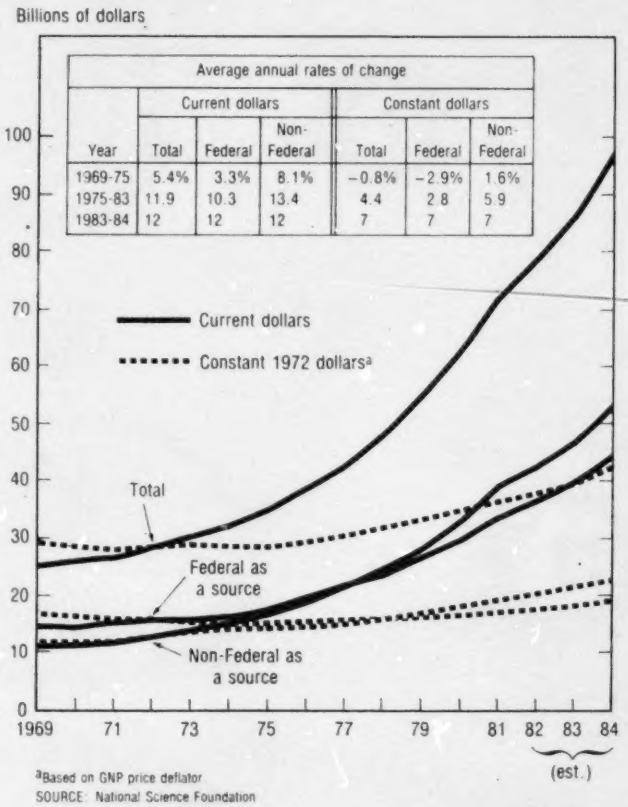
- In 1984, U.S. public and private sectors are expected to provide a combined total of $97 billion for research and development. If inflation is held to 5 percent over 1983, as estimated by the Office of Management and Budget (OMB), real growth in research and development (R&D) expenditures can be expected to rise 7 percent above the 1983 level, well above the 4.4-percent annual average increase during the 1975-83 period (chart 1).

- Two factors are primarily responsible for this estimate of a significant increase in 1984 R&D support. A major thrust in defense spending has been proposed in the 1984 Federal budget; Department of Defense (DOD) R&D support for that year was set at 29 percent over that agency's 1983 level. Secondly, economic conditions are expected to improve the climate for corporate investment in future markets through research and development.

- Indicators point to real growth of about 6 percent to 7 percent in both research and development activities with components of both basic and applied research estimated to grow at about similar rates. Increases by Government and industry are anticipated for both research areas. Government funding, following the record of the past several years, will most likely be the major factor in the basic research growth while industry will provide the larger thrust to applied research support.

- With respect to the ratio of R&D expenditures to gross national product (GNP), the United States, with a 2.7-percent average, draws closer to West Germany and continues ahead of the other major industrialized western economies in R&D spending relative to total economic

Chart 1. National R&D expenditures



[a]Based on GNP price deflator
SOURCE: National Science Foundation

Prepared in the R&D Economic Studies Section, Division of Science Resources Studies

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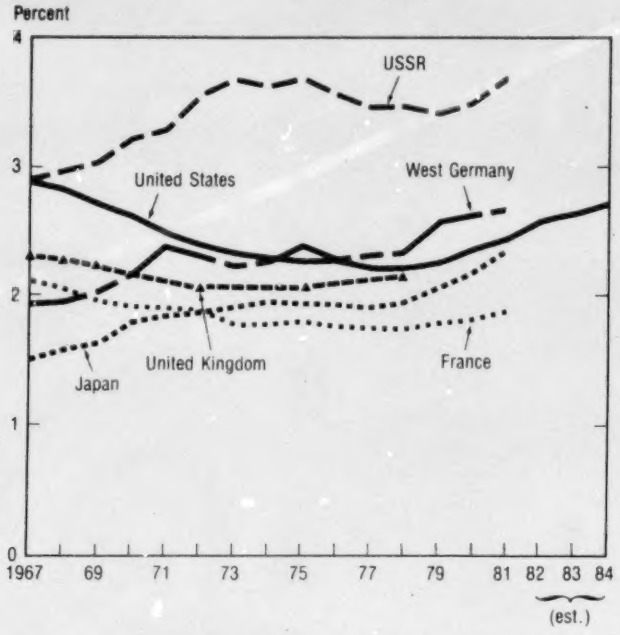
Chart 2. International R&D/GNP



SOURCE: National Science Foundation and Organisation for Economic Co-operation and Development

activities (chart 2). Excluding defense, however, places the United States at 1.9 percent, below both West Germany (2.6 percent) and Japan (2.3 percent).

R&D/GNP

U.S. R&D expenditures are expected to reach 2.7 percent of the GNP during 1984, up from 2.6 percent in 1983, reflecting a constant-dollar rate of increase in R&D funds amounting to nearly two times that of the GNP (chart 3). This continues the gradual increase in the R&D/GNP ratio from the 1977-78 low of 2.2 percent. Real growth in the GNP is estimad by OMB at 4.3 percent in 1984, nearly two times the annual average over the preceding 14 years. R&D expenditures in 1984 are expected to be 7 percent higher in constant dollars than in 1983 as a result of a sharp rise in Federal defense R&D funds and increases in industry's own investment in research and development.

The steady growth in this Nation's R&D/GNP ratio since the later seventies has brought U.S. R&D expenditures relative to GNP close to those of West Germany for the first time in several years. After experiencing a gradual increase in its R&D/GNP ratio for twenty years, Japan has shown a sharp increase in recent years, going from 1.9 percent in 1979 to 2.4 percent in 1981; the latest year for which data are available. Comparable ratios for the United Kingdom

Funds for research and development

[Dollars in millions]

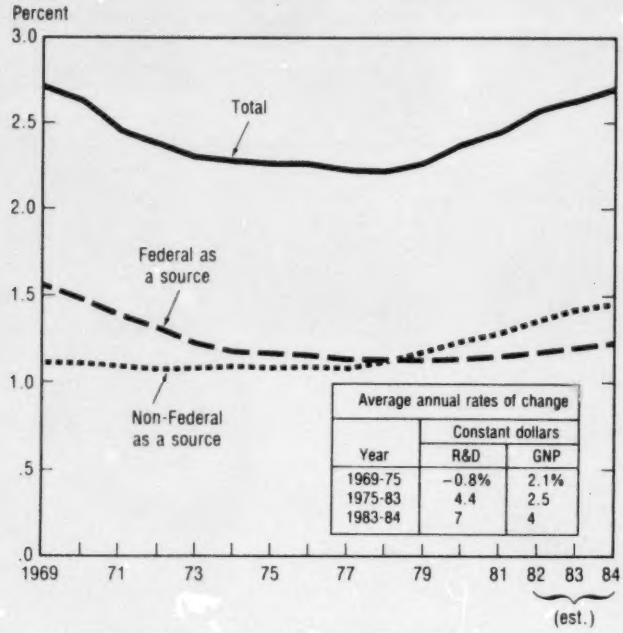
Year	Total	Federal Government	Industry[1]	Academic sector		Other nonprofit institutions[1]
				Universities and colleges	Associated FFRDC's[2]	
	By performer					
1975	$35,213	$ 5,354	$24,187	$3,409	$ 987	$1,276
1976	39,016	5,769	26,997	3,727	1,147	1,376
1977	42,829	6,060	29,825	4,065	1,384	1,495
1978	48,184	6,870	33,304	4,621	1,717	1,672
1979	54,972	7,463	38,226	5,354	1,935	1,994
1980	62,734	7,769	44,505	6,050	2,235	2,175
1981	72,118	8,729	51,830	6,793	2,476	2,290
1982 (est.)	79,000	9,250	57,850	7,010	2,540	2,350
1983 (est.)	86,500	9,750	64,250	7,400	2,600	2,500
1984 (est.)	97,000	10,500	73,300	7,825	2,725	2,650
	By source					
1975	$35,213	$18,109	$15,820	$ 749	—	$ 535
1976	39,016	19,914	17,694	808	—	600
1977	42,829	21,642	19,629	887	—	671
1978	48,184	23,933	22,450	1,035	—	766
1979	54,972	26,860	26,081	1,194	—	837
1980	62,734	29,716	30,771	1,314	—	933
1981	72,118	33,752	35,897	1,512	—	957
1982 (est.)	79,000	36,610	39,955	1,540	—	895
1983 (est.)	86,500	39,625	44,285	1,615	—	975
1984 (est.)	97,000	44,500	49,750	1,700	—	1,050

[1]Includes expenditures for FFRDC's administered by this sector. They account for less than 5 percent and 15 percent, respectively, of the industry and nonprofit performance totals.

[2]Federally Funded Research and Development Centers (FFRDC's) administered by individual universities and colleges and by university consortia.

SOURCE: National Science Foundation

Chart 3. R&D/GNP



Average annual rates of change

Year	Constant dollars R&D	Constant dollars GNP
1969-75	−0.8%	2.1%
1975-83	4.4	2.5
1983-84	7	4

SOURCE: National Science Foundation and Department of Commerce.

and France show R&D expenditures at 2.1 percent and 1.9 percent of the GNP, respectively. If defense-related R&D monies are excluded from the comparison of country R&D expenditures, the United States, with a civilian R&D/GNP ratio of 1.9 percent, ranks below both West Germany (2.6 percent) and Japan (2.3 percent).

R&D Support

The Nation's R&D performance is expected to reach an estimated $97 billion in 1984, approaching a level in current dollars nearly three times that of 1975, the last year to show a real-dollar decrease in R&D spending. After calculating the effects of inflation, the 1984 R&D totals show a 50-percent increase over R&D expenditures in 1975. Between 1975 and 1982 the Nation increased its R&D funding at an average annual rate of 4.4 percent in constant dollars, which required an average yearly growth of 12.2 percent in current dollars.

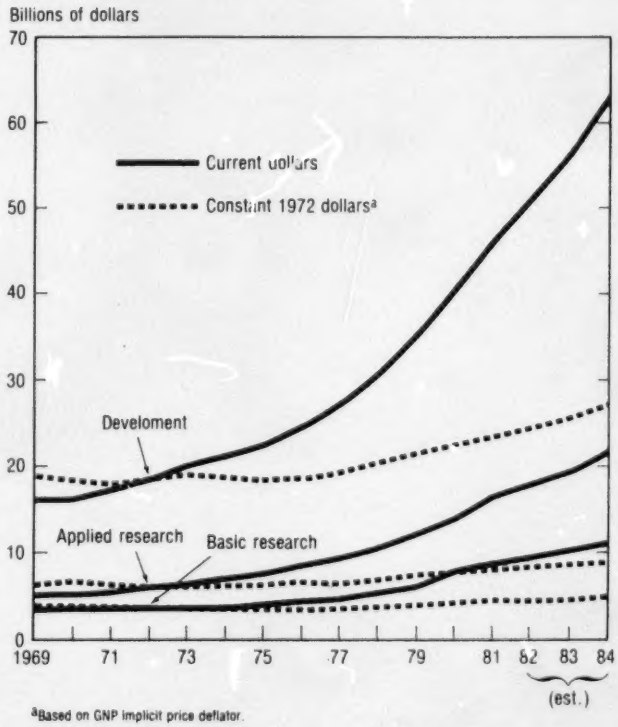
A 12-percent increase over 1983 is expected in the Federal Government's R&D spending in 1984. This will be the first year since 1975 that Federal R&D funds matched the growth rate of industry funds. Emphasis on increased expenditures for defense-related R&D programs as proposed by the President in the 1983 and 1984 budgets is the major factor contributing to the sharp upturn estimated for 1984 Federal R&D spending.

More than one-half the Nation's support for research and development originates in non-Federal sources of which U.S. industry supplies about 95 percent. Non-Federal R&D support in 1984 is estimated at about $52 billion, 12 percent over the 1983 level. This represents real growth of about 7 percent, most of which will come from industry. Academic institutions' and other nonprofit organizations' contributions to national R&D spending are expected to show, at most, a 1-percent to 2-percent real increase over 1983 levels. One explanation industry officials frequently give for the anticipated growth in R&D spending in 1984 is their cautiously optimistic view of the Nation's economic recovery from the recent recession. According to company representatives, however, U.S. industry's efforts to maintain and enhance their competitive position among high-technology firms throughout the major industrialized countries in the world has been the major driving force behind the 6.1-percent average annual real growth in industry's R&D support since 1975. These efforts by industry are expected to continue through 1984 and beyond.

Basic Research, Applied Research, and Development

Federal proposals for defense spending contained in the 1984 budget and U.S. industry's historically heavy emphasis on development activities primarily account for the estimated increase of more than 7 percent in constant dollars in the Nation's funding of development in 1984 (chart 4). This compares with an average annual 4.5-percent increase between 1975 and 1983. About two-thirds of the Nation's total R&D expenditures are generally devoted to development. U.S. industry has been both the major source of development funds (about 55 percent) and the major performer of development (about 85 percent).

Chart 4. National basic research, applied research, and development expenditures



[a]Based on GNP implicit price deflator.
SOURCE: National Science Foundation

The Nation is expected to increase research support by more than 6 percent in constant dollars in 1984 compared to a 4-percent average annual increase during the previous 8 years. Applied research has gradually gone up in its share of total research expenditures over the years, growing from six-tenths in 1969 to two-thirds in 1983. Industry, which accounts for 60 percent or more of the performance of applied research, surpassed the Federal Government as the major source of applied research funds around 1980. These two sectors together are expected to increase applied research support in 1984 to $22 billion, matching the 6-percent constant-dollar growth estimated for total research expenditures.

Funding for basic research in 1984 is also expected to rise at a substantially faster rate than the prior 8-year average. The $5 billion estimated for basic research in 1984 represents nearly a 6-percent increase over 1983 in constant dollars compared to a 3.2-percent average annual rate between 1975 and 1983. University laboratories housed about one-half the Nation's basic research effort, as measured in expenditures, of which the Federal Government provided 70 percent. Industry ranked second among the major sectors, accounting for about one-fifth of the national basic research total. Companies' own funds are the source of $8 of every $10 spent for basic research performed in industry laboratories. Worth noting is the growing tendency of industry to fund basic research in universities; since 1975 the growth in company funds for basic research in university laboratories has exceeded by one-third the rate of growth of Federal funds. Industry's share of universities' total basic research expenditures, however, remains small—about 3 percent of the total.

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